

5) Explain carbohydrates in cellulose-based water filters production.

A) Cellulose based water filters are filters made from cellulose.

cellulose → carbohydrate polymer found in plant cell walls.

They are used to remove impurities and contaminants from water, as an alternative to traditional, synthetic polymer filters.

High mechanical strength and hydrophilic properties of cellulose make it ideal for water filtration.

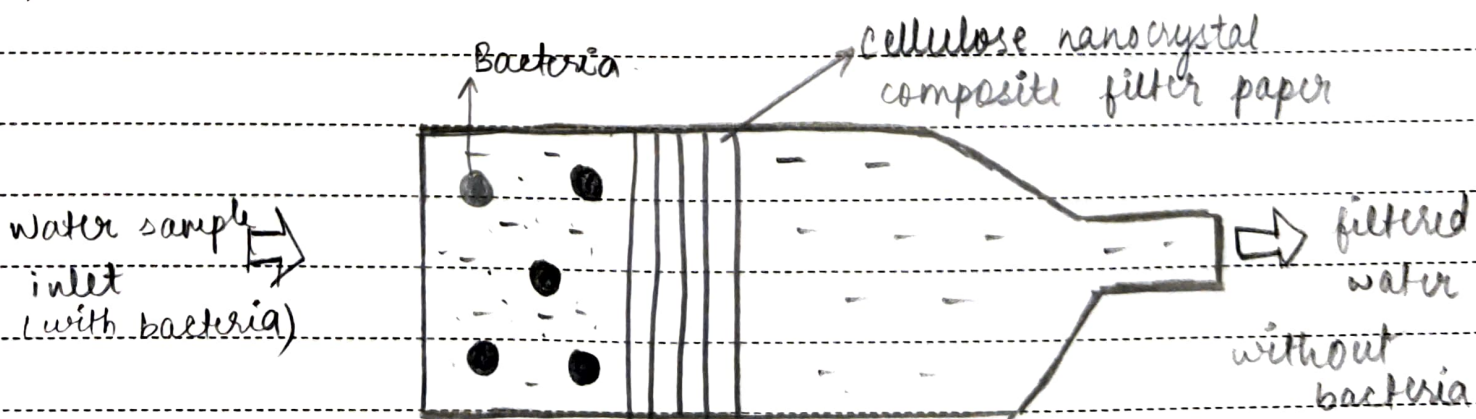
They can effectively remove pathogens and other particles from water making it safe.

Cellulose based filters are widely used in both countries for household, industrial and agricultural applications, they are:

Environment friendly and are biodegradable.

• Properties of cellulose based water filters:

- 1) High Porosity
- 2) Biodegradability
- 3) Cost effective
- 4) Renewable source



• Importance of cellulose based water filters :

- 1) provides clean and safe water, potable for various applications
- 2) sustainable since its made up of renewable resources
- 3) Affordable and hence used by wide range of customers
- 4) Versatility : cellulose based water filters can be used in various types of filtration systems

• Advantages of cellular based water filters :

- 1) Environmentally friendly
- 2) Cost effective
- 3) High porosity
- 4) Chemical resistance
- 5) Large surface area.

• Limitations of cellular based water filters :

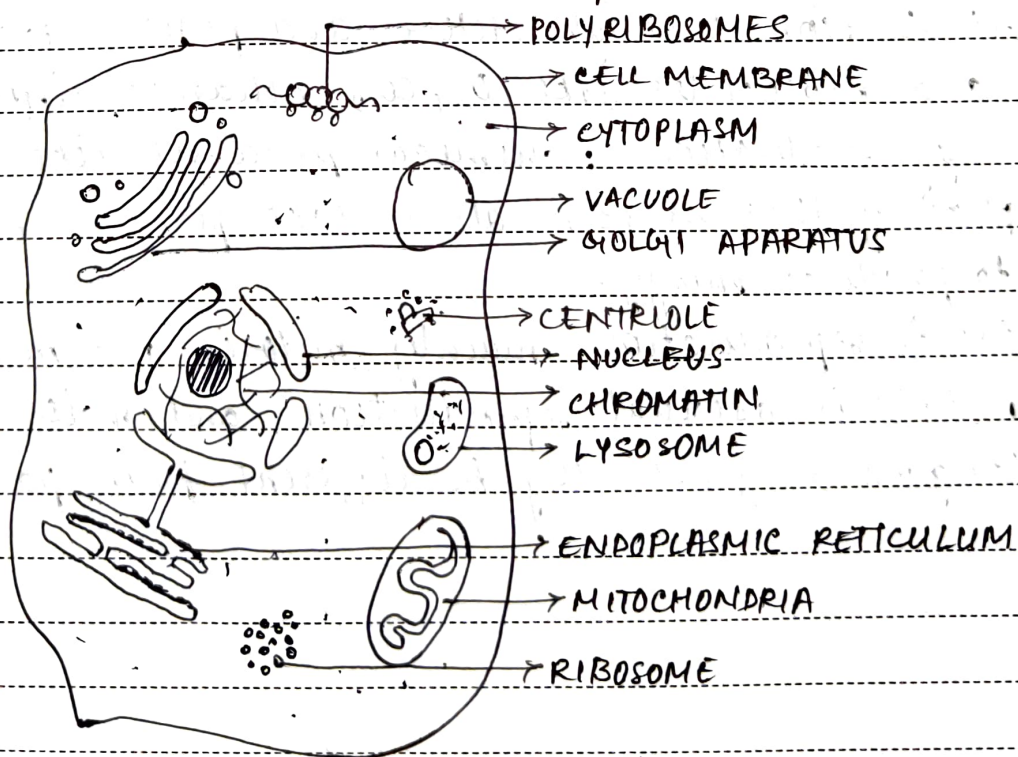
- 1) Low resistance to high temperatures
- 2) Low filtration efficiency for certain contaminants
- 3) Limited lifespan
- 4) May clog easily.
- 5) may affect water taste.

Q1) Explain structure and functions of a cell.

A) The cell is the basic unit functional unit of life, we need cells to ~~to~~ respire, obtain energy, remove waste, and for other metabolic functions.

Structure of the cell:

1. cell wall: covers the cell and protects the cell and gives a definite shape.
2. cell membrane: it is the house for all the cell organelles.
3. Plasma membrane: surrounding cell, enables passage of substances.
4. cytoplasm: jelly like substance, filling the cell, contains organelles.
5. Nucleus: Houses the genetic material (DNA), controls cell activity.
6. Organelles: specialized structures:
 - endoplasmic reticulum: involved in protein and lipid metabolism.



ANIMAL CELL

- golgi apparatus : modifies , sorts , packages the molecules
- mitochondria : generates energy through respiration
- lysosomes : break down the waste materials
- ribosomes : protein synthesis of the cell
- vacuoles : store food , water and waste material
- nucleus : controlling cellular activities and cellular reproduction.

→ functions of the cell :

- 1) support and structure : the cells forms large cells such as on the skin and also xylem cells in plants for support
- 2) facilitate growth mitosis : parent cell divides into daughter cells and so on they multiply and facilitate growth.
- 3) Allows transport of substances : helps in waste elimination through active and passive transport and molecules like O_2 , CO_2 , ethanol diffuse out.
- 4) energy production : chemical processes like photosynthesis or respiration take place in order to produce energy.
- 5) Aids in reproduction : mainly mitosis and meiosis , mitosis is asexual reproduction and meiosis causes daughter to genetically be different from parent

Q2) Describe stem cells and their applications :

A) stem cells have the ability to repair damaged cells (healing power) can evolve into any type of cell

Types of stem cells :

(a) Embryonic stem cells : fertilized egg begins to divide immediately, all cells in young embryo are totipotent cells, form hollow structure, cells in one region group together form the inner cell mass, contains pluripotent cells that make up the developing foetus.

Types of Embryonic cells :

- Totipotent cells
- pluripotent cells
- multipotent cells
- oligopotent cells
- unipotent cells

(b) Adult stem cells : obtained from developed organs and tissues, replace & repair damaged tissues.
Hemopoietic cells (Bone marrow transport)

(c) Induced Pluripotent cells : these cells are tested and arranged by converting tissue specific cells into embryonic cells in lab, useful for testing various drugs, share same characteristics as embryonic cells, have potential to give rise to all different types of cells in human body.

(d) Mesenchymal stem cells : formed by connecting tissues surrounding, other tissues and organs (stroma), called stromal cells, have been developed by different tissues of human body.

→ Applications of stem cells :

- 1) Tissue Regeneration : used in kidney & liver transplants, and also, tissue grafting.
- 2) Treatment cardiovascular disease : this was tested on mice, in which, the blood vessels formed network after implanting on mice.
- 3) Treatment of Brain disease : stem cells are used to replenish the damaged brain cells.
- 4) Blood disease : stem cells produce red & white blood cells in body.

Q-4 Explain the properties and function of the following :

1) Enzymes 2) Vitamins 3) Hormones

Ans ENZYMES :-

* PROPERTIES :-

- Enzymes are biological polymers, primarily proteins, with catalytic capabilities.
- They consists of a linear chain of amino acids that folds into a specific three-dimensional structure.
- Each enzyme has an active site responsible for binding the substrate and catalyzing reactions.
- Enzymes are generally large molecules compared to their substrates.
- Their activities are highly specific and is affected by factors like temperature, pH and inhibitors.

* FUNCTIONS :-

- Enzymes accelerate biochemical reactions without being consumed.
- They either break down large molecules or combine smaller molecules into larger ones.
- Essential for various life processes, including respiration, digestion, excretion, metabolic activities.
- Involved in : signal transduction, Energy production, Regulation of cellular activities.

2) VITAMINS :-

* PROPERTIES :-

- Organic compounds required in small amounts ^{for} biological functions.
- Essential for growth, maintenance and overall health.
- Deficiency can leads to specific diseases.
- Fat soluble vitamins (A, D, E, K) → stored in Adipose tissues.
- Water soluble vitamins (B-complex, C) → Not stored in body, must be supplied regularly.

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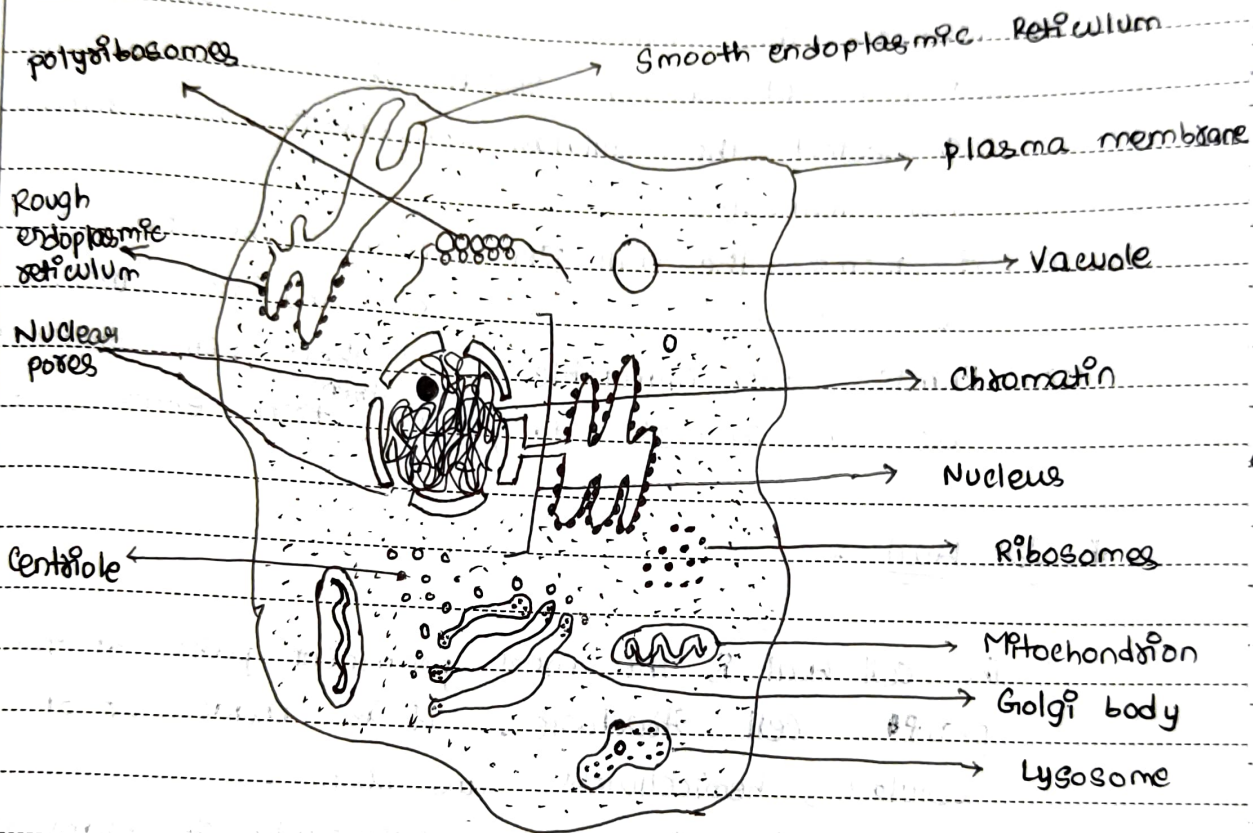
FUNCTIONS :-

- Different vitamins have distinct biological roles :
 - Vitamin A → Important for vision.
 - Vitamin D → Crucial for bone growth.
 - Vitamin K → Essential for blood clotting.
- Help maintain overall body functions and health.

Q-1 Explain Structure and function of a cell

Ans → A cell is defined as the smallest, basic unit of life that is responsible for all the life's processes

* Structure of the cell :-



→ The cell structure comprises individual components with specific functions essential to carry out life's processes. These components include - cell wall, cell membrane, cytoplasm, nucleus, and cell organelles.

Cell Membrane :-

→ The cell membrane supports and protects the cell. It controls the movement of substances in and out of the cell. It separates the cell from the external environment.

- The cell membrane is present in all the cells.
- The cell membrane is the outer covering of a cell within which all of other organelles, such as the cytoplasm and nucleus, are enclosed. It is also referred to as the plasma membrane.
- By structure, the porous membrane (with pores) which permits the movement of selective substances in and out of the cell. Besides this, cell membrane also protect the cellular components from damage and leakage.
- It forms the wall like structure between two cells as well as between the cell and its surrounding.
- Plants are immobile, so their cell structures are well adapted to protect them from external factors.

* Cell Wall :-

- The cell wall is the most prominent part of the plant's cell structure. It is made up of cellulose, hemicellulose and pectin.
- The cell wall is present exclusively in plant cells. It protects the plasma membrane and other cellular components. The cell wall is also the outermost layer of plant cells.
- It is rigid and stiff structure surrounding the cell membrane.
- It provides shape and support to the cells and protect them from mechanical shocks and injuries.

* Cytoplasm :-

- The cytoplasm is a thick, clear, jelly-like ~~structure~~ substance present inside the cell membrane.
- Most of the chemical reactions within a cell take place in this cytoplasm.
- The cell organelles such as endoplasmic reticulum, vacuoles, mitochondria, ribosomes, are suspended in this cytoplasm.

* Nucleus :-

- The nucleus contains the hereditary material of the cell, the DNA.
- It sends signal to the cells to grow, mature, divide and die.
- The nucleus is surrounded by the nuclear envelope that separates the DNA from the rest of the cell.
- The nucleus protects the DNA and is an integral component of a plant's cell structure.

* cell organelles :-

⇒ Nucleolus ⇒ The nucleolus is the site of ribosomes synthesis. Also, it is involved in controlling cellular activities and cellular reproduction.

⇒ Nuclear membrane ⇒ The nuclear membrane protects the nucleus by forming a boundary between the nucleus and other cell organelles.

- ⇒ Chromosomes ⇒ Chromosomes plays a crucial role in determining the sex of an individual. Each human cell contains 23 pairs of chromosomes.
- ⇒ Endoplasmic reticulum ⇒ The endoplasmic reticulum is involved in the transportation of substances throughout the cell.
- ⇒ Golgi body ⇒ Golgi body are called the cell's post office as it is involved in the transportation of material within the cell.
- ⇒ Ribosomes ⇒ Ribosomes are the protein synthesizers of the cells.
- ⇒ Mitochondria ⇒ The mitochondrion called "the powerhouse of the cell." It is called so because it produces ATP - the cell's energy currency.
- ⇒ Lysosomes ⇒ Lysosomes protect the cell by engulfing the foreign body entering the cell and help in cell renewal. Therefore, they are known as the cell's suicide bag.
- ⇒ Vacuoles ⇒ Vacuoles store food, water and other waste materials in the cell.

* Function of a cell :-

- Provides Support and Structure
- Facilitate Growth Mitosis
- Allows Transport of Substances
- Energy Production
- Aids in Reproduction

4. a)
1.

Enzymes are ^{as} proteins organic molecules which acts as a biocatalyst and speeds up processes in us.

Properties:

- Enzymes acts as a biocatalyst
- Enzymes are chemically active
- They are reactive in nature
- They can sustain high temperatures and pressure and perform well.
- They are substrate specific: Enzymes react to their specific substrate and are inert to others
- They speed up metabolism and other processes in the body.

Functions:

- Lots of enzymes are involved as a catalyst during metabolism.
- Enzymes help speed up all processes in our body like digestion, synthesis or respiration
- Enzymes also acts as a protective agent for its substrates
- Can act as a biosensor and bio-leaching agent

2. Vitamins:

Vitamins are compounds which are essential for various functions and regulations in our body

Properties:

- Vitamins are present everywhere in the body
- Some vitamins are water soluble and some are not
- There are various sources of vitamins from around us in nature
- Deficiency of these vitamins can cause various diseases such as scurvy, rickets, cheilosis, night blindness, etc.
- We get vitamins from plants, animals and other sources as well

Functions:

- They are present in the cornea of the eye and help us see
- Vitamin D induces colouration of skin
- Vitamin C brings a glow to the skin and face
- Vitamin B12 plays a vital role on our health.

1) Explain Nucleic acids in vaccines and diagnosis :

- 1) DNA vaccine for rabies
- 2) RNA vaccine for covid19
- 3) Forensics - DNA fingerprinting

A) Nucleic acids are essential biopolymers responsible for genetic information storage and transfer.

- DNA (Deoxyribonucleic Acid) : Double-stranded helix carrying genetic instructions for development and reproduction.

- RNA (Ribonucleic Acid) : single-stranded molecule that helps express genetic information by carrying DNA's message for protein synthesis.

1) DNA vaccines for rabies :

A DNA vaccine introduces rabies virus DNA into the body, prompting an immune response.

- Highly effective in preventing rabies
- Provides long lasting protection with fewer doses
- Easy to administer via injection or orally
- Cost effective and easier to manufacture
- Safe, as it does not contain live virus particles.

3) DNA fingerprinting in forensics

DNA fingerprinting is a forensic technique used to identify individuals based on their unique DNA profile.

- Sample collection: DNA is extracted from blood, hair or bodily fluids
- DNA Amplification: Polymerase chain reaction (PCR) creates multiple copies
- Analysis: DNA fragments are separated using gel electrophoresis
- Comparison: Profiles are matched to suspects or victims
- Applications: criminal investigations, Exoneration, Disaster victim identification, Paternity testing

USN

Internal Assessment Test 1 – March 2025

Sub:	BIOLOGY FOR ENGINEERS					Sub Code:	BBOC407	Branch:	AIML /CSE(AIML)		
Date:	24/03/25	Duration:	90 minutes	Max Marks:	50	Sem/Sec:	IV			OBE	
<u>Answer any FIVE FULL Questions</u>									MARKS	CO	R B T
1	a	Describe Stem Cell and their application.							[10]	1	L
2	a	Explain the applications of enzymes in biosensors and Bio- bleaching							[10]	2	L
3	a	Explain Structure and functions of a cell with diagram.							[10]	1	L
4	a	Explain Properties and functions of following: 1.Enzymes 2. Vitamins							[10]	1	L
5	a	How can you demonstrate the effectiveness of cellulose as a material for water filtration based on its properties?							[10]	2	I
6	a	How can you interpret the development of DNA vaccines with an example?							[10]	2	I

Diya Mani-25
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24/3/25